# BRIDGER FORMATION IN THE BRIDGER BASIN, WYOMING

BY

KARL JOSEPH KOENIG

B.S., University of Illinois, 1941
M.S., University of Illinois, 1946

## AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN GEOLOGY
IN THE GRADUATE COLLEGE OF THE
UNIVERSITY OF ILLINOIS, 1949

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The purposes of this paper are (1) to present the results of a stratigraphic study of the Bridger formation in the Bridger basin; (2) to point out the nature and continuity of certain beds in the formation; (3) to present the successive interpretations given to the climate and physiography of Bridger time by geologists during the past eighty years; (4) to interpret the climatic and physiographic conditions that existed during the deposition of the Bridger formation, on the basis of lithologic character of the sediments and the enclosed vertebrate and plant remains; (5) to determine if possible the source area for the Bridger sediments.

The Bridger basin is a broad, gently dipping, spoon-shaped syncline with an essentially north-south axis. The combined effect of the gentle dip and the resistant calcareous layers at various levels within the formation governs the present distribution of the Bridger beds in the basin. The oldest beds are exposed around the margins of the formation with successively younger beds exposed in a series of terraces in the southern part of the basin. The youngest beds, preserved in the southern part of the basin by a thick cap of conglomerate, were either not deposited in the northern part of the basin or have been completely removed from this area by erosion.

Stratigraphic columns are presented which show in detail the lithologic sequence of the Bridger formation in five different parts of the basin. Several additional sections were measured and were used to complete the general picture of the environmental conditions which existed during Bridger time.

Representative samples, collected from every lithologic unit encountered in the sections measured, were subjected to laboratory analysis. Sand and silt sized components were examined under binocular and petrographic microscopes.

Individual grains were isolated and identified by their color, cleavage, and refractive indices. The insoluble fractions of all the limestones were examined. X-ray diffraction studies were conducted on some of the fine-grained deposits. Over forty thin sections were prepared and studied.

The Bridger formation is from 1762 to 1967 feet thick and is composed of the following types of sediments: (1) Thin fresh-water tuffaceous limestones, marls, and associated lacustrine mudstones and shales. Many of these beds contain an abundant fresh-water fauna consisting of ostracods, pelecypods, and gastropods. (2) Channel sandstone deposits. In several cases, due to the superior resistance of these deposits, the courses of old stream channels can be clearly traced for several miles. (3) Flood plain deposits. These deposits comprise the bulk of the Bridger formation. The richest vertebrate collecting zones are found in these deposits thereby lending credence to their flood plain genesis. (4) Deltaic and lacustrine sandstones and siltstones. These deposits occur as wedge-shaped or continuous beds associated with lacustrine limestones, mudstones, and shale. (5) Lignitic and coaly deposits. Thin, discontinuous beds of lignitic and coaly material are found at various levels within the Bridger formation. (6) Volcanic material. Volcanic material in the form of euhedral biotite, plagioclase feldspar (oligoclase to andesine), hornblende crystals, with glass and pumice fragments is found in all beds in the Bridger formation.

The evidence afforded by the sediments, the vertebrate and invertebrate remains, and the flora suggests that the Bridger basin was the site of valley flat, lacustrine, deltaic, and paludal deposition during Bridger time. The flora and vertebrate remains indicate warm temperate climatic conditions.

The fresh appearance of the mineral components in the Bridger sediments is attributed to rapid deposition rather than aridity as suggested by Sinclair (1906, p. 279).

The writer has subdivided the Bridger formation into

three principle subdivisions as follows: Lower Bridger, Middle Bridger, and Upper Bridger. This subdivision was made on the basis of recognizable and traceable calcareous members.

The Lower Bridger sediments were further subdivided into an A and B zone. The A zone in the southern part of the basin is composed of alternating lacustrine, lower valley flat, and deltaic deposits. It is separated from the B zone by a prominent white ostracodal limestone. This limestone does not occur in the northern part of the basin and therefore the A and B zones of the Lower Bridger cannot be differentiated in this area. However, the Lower Bridger B zone, consisting of valley flat, lower valley flat, deltaic, and lacustrine deposits, is well developed in the southern part of the basin.

Middle Bridger time was initiated by the first major flooding of the southern part of the basin since the close of Lower Bridger A time. A prominent calcareous sequence known as the Cottonwood Member was deposited in the lake resulting from this flooding. The sediments overlying this member are characterized by channel-fill sandstones and associated mudstones. Locally these sediments are interbedded with thin lacustrine and deltaic deposits. The lacustrine and deltaic beds are interpreted as the deposits formed in small ponds or lakes which dotted the valley flat.

At the beginning of the Upper Bridger time the southern one-third of the basin was once again covered by a shallow lake. The Henrys' Fork Table member composed of marl and crystal tuff was deposited in this lake. The Upper Bridger sediments like those of the Middle Bridger are characterized by channel-fill and associated mudstone deposits with local lacustrine and deltaic facies.

The absence of recognizable deltrital material, the remarkable similarity in mineral composition, and the presence of volcanic glass, pumice, cristobalite, and euhedral biotite and hornblende all suggest a volcanic origin for the Bridger sediments. The mineralogy of the Bridger pyroclastics sug-

gests an andesitic composition.

A critical study of the literature together with the observed data in the field was used to postulate the source of the pyroclastic materials in the Bridger formation. Although direct evidence is lacking, it is suggested that the volcanic activity responsible for the Early Acid Breccia in the Yellowstone National Park region was also responsible for the Bridger volcanics.

Volcanic material ejected from this source area was probably deposited in an elliptical pattern, elongated in an east-west direction because of prevailing winds. The Bridger basin, located over 200 miles south of this scene of volcanic activity did not receive continuous showers of pyroclastic material but rather had to depend upon streams which headed up in and beyond the extreme northern limits of the basin for the delivery of this ejecta. During occasional periods of extremely violent volcanic activity in the source area the basin was subjected to showers of volcanic ash. Some of this material was deposited in the small ponds and lakes where it became admixed with the limy and marly beds. The remainder fell upon the valley flat and was soon reworked by water action and redeposited in the stream channels or over the flood plains.

## REFERENCES CITED

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# VITA

Karl Joseph Koenig was born in Milwaukee, Wisconsin, January 9, 1920. After receiving his elementary education in Chicago, he attended Austin and Steinmetz High Schools in the same city, graduating from the latter in 1937. He then attended the University of Illinois and received his B.S. degree in 1941.

In June 1941 he was called into the service and was assigned to the 1st. Armored Division. He participated in the Tunisian and Italian campaigns. During the assault on Rome he was severely wounded and returned to the United States for hospitalization and ultimate retirement from the service.

Upon his retirement in 1946, he returned to the University of Illinois and served as a part-time assistant in geology while completing his work for the M.A. degree. During the summer of 1946, he attended the University of Michigan Rocky Mountain field camp located in the vicinity of Jackson Hole, Wyoming. Upon the completion of this work he received the M.A. degree from the University of Illinois.

From September 1946 to June 1947, he was a part-time assistant in geology at the University of Illinois. During the summer of 1947, he worked for the Pure Oil Company in southwestern Wyoming. From September 1947 to August 1948, he was once again a part-time assistant in geology at the University of Illinois. From September, 1948 to June, 1949 he held the Shell Oil Company Fellowship at the University of Illinois.

He is a member of the Geological Society of America, a member of Phi Sigma, and an associate member of Sigma Xi and the American Association of Petroleum Geologists.

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